

Risk assessment and management to enable access to credit for livestock actors

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Abstract

Credit rationing remains a major concern for livestock value chain stakeholders in particular for smallholders for who poor access to credit is one of the principal constraints to sustain their activities. Until present-day, the mismatch between credit supply and demand is usually tackled in Sub-Saharan Africa through the intrinsic attributes of credit applicants and very little or never through the prism of the unavoidable multifaceted livestock risk management in view to move forward to an enabling environment. This is the approach adopted in this paper, focused on Senegal livestock risk assessment and management as well as on thorough literature review, secondary data analysis, interviews with public and private corporations and national and international research institutions working in livestock sector. After identification, quantification, impact assessment and prioritization of multifaceted livestock risks, we demonstrate how risk management contributes to the emergence of an enabling environment and stimulate access to credit.

Key words: *credit rationing, risk assessment, risk management, credit access, Senegal*

Introduction

Between 2000 and 2012, Senegal's livestock sector contributed on average to 30% of agricultural GDP and 4.2% of total GDP, with average annual growth of 6.1% (Niang and Mbaye, 2013). The livestock production activity supports nearly 350,000 families, equivalent to 3,000,000 individuals (Niang and Mbaye, 2013), just over a quarter of the total population.

Given the large proportion of rural households keeping small and large ruminant livestock, the role of ruminant livestock to improve farmers' cash income and livelihoods is limited by the weak access to technologies and innovations themselves largely dependent to the availability of timely and adequate credit. Many small farmers are credit rationed (Reyes and Lensink, 2011:

1852).

As elsewhere in sub-Saharan Africa, access to credit for many smallholders in the livestock sector in Senegal is limited thus constraining the growth of the sector. Beyond household attributes that could seem to be determinant for credit access, the risky livestock environment limits access to finance and finally constraints its productivity that requires investments from value chain and financial actors. The mismatch between the supply of credit and the real investment needs often attributed to logistical challenges is also partly rooted in the high level of multifaceted risks. Most of empirical literature focused only on households 'attributes to explain credit rationing. However, it would be good also to produce evidence-based risk analysis of Sahelian livestock sector in view to provide useful information for enabling environment.

The purpose of our contribution is to demonstrate how livestock risk management should contribute to enable livestock environment and to facilitate access to credit. The *section 1* introduces a theoretical framework of the credit rationing. The *section 2* provides with livestock risk assessment in Senegal and describes initiatives developed for risk management. The *section 3* describes how to move forward for enabling environment for increasing credit supply.

Section 1 – Conceptual framework for measuring credit rationing

The supply and demand of credit are sometimes misaligned even irreconcilable. Based on the seminal work of Stiglitz and Weiss (1981) then an important contribution of Jaffee and Stiglitz (1990), credit rationing occurs in situation with asymmetric information in which lenders are not able to discriminate between high quality and low quality borrowers' attributes thus, leading to a non-Walrassian equilibrium that implies an excess demand for loanable funds. The term "credit rationing" is mainly used for two circumstances: first, when into a homogeneous group of applicants, some of them receive a loan and others do not regardless of the level of interest rates they consent to pay, and second, when there are identifiable social groups in the population unable to obtain loans at any interest rates and whatever the volume of available credit (Stiglitz and Weiss, 1981, 394-395). In other words, a potential borrower as being credit rationed if his private demand for credit persistently exceeds the loan amount offered by the lender (Petrick, 2005). However, linked exclusively credit rationing to asymmetric information has been strongly disputed as empirically, this situation could inversely lead to overlending situation (De Meza and Webb, 1987, 2000; Bonnet et al, 2016).

In addition, the literature widely addressed the causes of credit rationing. Beyond asymmetry information, credit rationing may arise from the difficulties to overcome excessive transaction costs, poverty situations, costs associated with screening, monitoring, and enforcement problems, collateralization issues, and risky environment in rural areas mainly in developing countries (Binswanger and Rosenzweig, 1986; Hoff and Stiglitz, 1993; Ghatak and Guinnane, 1999; Petrick, 2005).

Adequate access to credit should contribute towards improving livestock productivity and sustain intensification activities by facilitating access to technology and innovation, (Simtowe, Zeller, and Diagne, 2008, 2009). Adequate access to credit would contribute to farmers' livelihoods and their ability to purchase inputs and enhance investments (Reyes and Lensink, 2011). Inversely, credit rationed agents have more incentives to invest in less risky and less productive

technologies (Dercon, 1996). Furthermore, credit rationing could affect rural development by preventing households from diversifying these activities and move out to poverty (Reardon, 1997; Ellis, 2000).

In Sub-Saharan Africa, most of empirical literature focuses on determinants of households' participation or non-participation to credit programmes. It was the case in Ghana where non-participation was strongly explained by the fear of loan default and lack of savings while the factors that significantly influence farm households' participation are the gender status of the household head, its formal education level, the farm size, and its membership status in associations (Asante-Addo, 2016). Few contributions however found analysis by linking credit rationing to global uncertainties that characterize rural environment in the Sahel.

Section 2 – Livestock risk assessment analysis in Senegal

The livestock risk assessment provides a comprehensive and quantification of livestock risks in Senegal through a holistic approach (D'Alessandro et al, 2015; Wane and Mballo, 2016).

General context

Senegal livestock sector consists of three subsystems of livestock production: **1)** a pastoral subsystem based on mobility and extensive exploitation of natural resources and providing 549,737 TLU, or 19% of ruminants (cattle, Sheep, goats) in the Ferlo region that covers more than one third of the national territory; **2)** an agro-pastoral subsystem in the South-East region concentrating up to 67% of cattle and 62% of small ruminants from 2000 (Niang and Mbaye, 2013) and which are gradually developing to the detriment of transhumant pastoral subsystems and **3)** an intensive and semi-intensive subsystem in the Niayes' region mainly producing poultry, eggs, pigs and, to a lesser extent, ruminants, particularly for dairy production.

This animal production activity in Senegal is evolving in a global context of severe socio-ecosystem shocks, as well as a deficit in infrastructure, basic social and economic services, and a sub-optimal and unfavorable environment (only 4% of investments in agricultural sector and difficulties to enforce legal provisions adapted to livestock dynamics). In addition to these constraints, the livestock subsector in Senegal is facing climate-related shocks that are both a direct source of loss and an aggravating factor of economic, health, and political and social threats.

Methodological approach

Our study mostly tackles risk assessment rather than constraint analysis even though there are still obvious links between constraints and risks. Assessing risks in livestock sector involves risk profiling, identification, and inventory of current risk management initiatives, risk quantification, multiscale impacts and prioritization in order to facilitate risk management decision-making.

We had a complete and very thorough analysis of the literature related to the livestock dynamics in the Sahel in general and Senegal in particular. We compiled secondary data collected by the public technical services, national and international research institutions and private companies then processed these data for statistical purposes by using various techniques (Monte Carlo

simulations, Extreme Value Theory, descriptive statistics, mapping). We interviewed each segment of the livestock value chain stakeholders to better identify their perception of livestock sector strengths, weaknesses, opportunities and threats (SWOT analysis). A prioritization approach allowed us to classify the identified risks according to their severity, frequency and potential impacts. Finally, we went back to the main livestock stakeholders through a final Workshop held in Dakar in June 2016 with the objective to assess reasons for potential discrepancy analysis.

Table 1 – Characteristics of data used and analytical methods

Types of data	Length of the series	Sources	Methods
Temperature	Monthly data, 1960-2014	<i>National Civil Aviation and Meteorology Agency of Senegal (ANACIM-Agence Nationale de l'Aviation Civile et de la Météorologie)</i>	Monte Carlo simulation and Extreme Value Theory, time series analysis
Bushfires	Annual data, 2003-2013	Ecological Monitoring Centre (CSE-Centre de Suivi Ecologique)	Descriptive statistics, Extreme Values Theory
Animal diseases	2014-2015	Directorate of Veterinary Services (DSV-Direction des Services Vétérinaires)	Descriptive statistics, mapping
Markets	Monthly data, 2012-2016	Commissariat for Food Security (CSA - Commissariat à la Sécurité Alimentaire)	Descriptive statistics, time series analysis
Conflicts	Annual data, 1960 to 2015	FAOSTAT (indirect measures based on the cattle decrease on some periods)	Descriptive statistics, Secondary data analysis
Cattle thefts		Directorate of Livestock - Livestock Theft Unit (Direction de l'élevage – Unité de suivi des vols de bétail)	Secondary data analysis

Risk assessment

The livestock situation in Senegal is mixed. It remains sensitive to multifaceted risks that could lead to physical and financial damage. Quantifying the financial costs of losses is really challenging as this is subject to significant data, statistical and model uncertainty. Using our own calculations and estimates from public and research institutions, we were able to determinate the overall financial costs of the identified risks related to Senegalese livestock sector. Under strong assumptions, the minimum average annual cost is estimated at **XOF 601.05 billion (almost USD 1 billion in current values)**.

Risk prioritization¹

On the basis of criteria of severity, frequency and impacts, the scores obtained made it possible to prioritize risks related to livestock sector: the dominant risk with a score of 5 is bushfires followed by risks related to animal health (4.60); to rainfall (3.84); markets (2.52), conflicts (1.81) and locust invasions (1.31).

¹ A risk scoring is used following a PARM-IFAD risk assessment methodology. The frequency, the average severity and the worst case scenario were scored and weighted based on the following formula to reflect the greater importance of average losses as a better indicator for the long term cost of risk:

$$\text{Risk Score} = 0.75 * (\text{Average Severity} * \text{Frequency})^{0.5} + 0.25 * \text{Worst Case}$$

Risks	Worst Case Scenario Severity	Average Frequency	Average Severity	Score
Bushfires	Very high	Very high	Very high	5.00
Animal diseases	Very high	Very high	Very high	4.60
Climate	Very high	Medium	Very high	3.84
Markets	Very low	Very high	Very low	2.62
Conflicts	Medium	Very low	Very low	1.81
Locust invasions	Very low	Very low	Very low	1.31

Depending on the agro-ecological regions specifically monitored as the main livestock areas, the hierarchy is changing due to the socio-ecosystemic realities: bushfires are a repetitive and very high risk in all livestock areas. Risks related to input deficits are strongly pronounced in the Niayes and Ferlo regions. Regarding rainfall variations, only the Southeast region seems to be more or less protected from this phenomenon. Conflicts have recently affected more the very sensitive region of the Ferlo closer to Northern Mali and Mauritania. It is also important to consider the persistent internal conflicts in Casamance, the Southern region of the country.

Risks	Ferlo region	Niayes' region	South-East region
Bushfires	Very high	Very high	Very high
Animal diseases	Medium	Very high	Very high
Climate	Medium	Medium	Very low
Markets	Medium	Medium	Medium
Conflicts	Very high	Very low	Very low
Locust invasions	Very low	Very low	Very low

Section 3 – Risk management to make progress in creating an enabling environment

In the risky livestock environment, the government of Senegal (GOS) have historically and successively taken global and specific approaches for livestock sector development to help rural populations in general and people living with livestock in particular to cope with persistent risks.

In terms of general measures, public authorities had launched two umbrella documents to support livestock sector development for 2011-2015: the Accelerated Growth Strategy document and the Economic and *Social* Policy paper. These documents develop options and strategies aimed at securing pastoral and agropastoral farming systems and fostering farms capable of meeting the challenges of interior demand for animal products with the main objectives to increase livestock productivity, productions and incomes in Senegal. This was operationalized through the National Plan for the Development of Livestock (PNDE), validated in June 2013, as a provision of the Agro-Sylvo-Pastoral Act (LOASP) promulgated on 4 June 2004.

Other multi-sectoral initiatives were launched in 1998 with the establishment of the National Food Security Council (CNSA) attached to the Prime Minister's Office and responsible for regular assessing of the food and nutritional situation of Senegalese populations.

In addition, through the National Adaptation Programs of Actions (NAPAs) adopted in 2006, the GOS is pursuing the objective of reducing the vulnerability of production systems and better anticipating risks that could arise from climatic disturbances.

In order to facilitate access to credit for livestock professionals, the GOS set up a Stabilization Support Fund (FONSTAB) on 6 November 2007 but did not start until June 2009. Measures have taken the form of various instruments: **1)** a Guarantee Fund to provide to the banks and financial institutions with coverage for counterparty risks up to 50% of loss-related loans; **2)** the interest rate subsidy fund to enable livestock professionals to benefit from the lowest rates in the agricultural sector; **3)** the Credit Fund to refinance the financing institutions approved by the Fund; and **4)** the line of credit based on Islamic Finance.

However, this coherent institutional network has not always succeeded in protecting totally the country from a number of threats on the livestock sub-sector. Some of these threats have been specifically addressed.

Risks	Risk management procedures and instruments
Bushfires	Every year, much of Senegal is affected by bush fires, which have a considerable impact on the development of the vegetation. The Ecological Monitoring Centre, a national entity whose core activities include environmental monitoring, natural resources management and conducting environmental impact assessments, was charged to monitor fires by remote sensing since 1990 in view to help the Directorate of Waters, Forests, Hunting and Wildlife conservation to provide with the identification and management of bush fires.
Animal diseases	The Directorate of Veterinary Services has set up a National Epidemiological Surveillance System (NESS) to monitor priority diseases. This surveillance system is carried out through <i>a passive surveillance</i> based on field reports, entered in a data sheet and sent to the veterinary laboratory of ISRA for confirmation or invalidation and an <i>active surveillance</i> based on the follow-up of a network of sentinel herds and during periods of risk, samples are taken and analyzed following a very rigorous quantitative protocol.
Climate and feeding	As of July 28, 2008, an initiative resulting from a PPP resulted in the establishment of the National Fund of Agricultural Insurance of Senegal (CNAAS), a public limited company. For the "Livestock" component, the CNAAS aimed to gradually cover the national herd with an average unit premium of 5% of the animal's value, i.e. 2.5% to be paid by the farmer. Amongst instruments, there is a "rainfall deficit" policy that combines traditional and index insurance programs. However, given the persistent intensity of climate shocks, the GOS has undertaken a complementary initiative by investing in the programming and implementation of a disaster risk management system based on the OSB (Livestock Safeguarding Operation) that organizes distribution of feed supplements to protect at-risk breeding livestock (lactating females, calves). In addition, some risks have been transferred to the Pan-African drought index insurance facility under the Agricultural Risk Capacity (ARC) initiative, a joint venture launched by the African Union to provide parametric insurance to cover climate shocks. The ARC uses satellite data sets to monitor rainy seasons, followed by a Water Satisfaction Index (WRSI) developed by FAO as a drought indicator, and estimates Of potentially threatened populations to establish emergency response costs.
Markets	While receiving technical and financial support from the World Food Program, the Commissariat for Food Security (CSA) develops monthly bulletins on agricultural markets, expanded to include price monitoring on sentinel cattle markets. Beyond this, the CSA has also the duty to regulate the markets for local cereals, to provide transversal studies and appropriate measures for decision-making process.
Cattle theft	With the growing concern over livestock theft, the GOS has set up the Livestock Theft Unit (CLVB), a structure attached to the Cabinet of the Ministry of Livestock to provide a framework for the implementation of policies and reforms. Livestock thefts are subject to passive surveillance based on the reports of thefts reported at the level of the gendarmerie services which establish hand-rails recorded on cards sent to the Directorate of Livestock.
	Beyond the multiple consultation frameworks locally initiated throughout the country, Senegal needed

Conflict	a long-term vision to secure pastoral land. In March 2013, the new authorities of Senegal decided to initiate the process of drawing up a pastoral code with the aim of enabling the country to have a legal framework updated and adapted to current realities of livestock in Senegal. The Senegalese Pastoral Code will make it possible to update all existing laws and to formalize the livestock development framework in Senegal.
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Population-specific discussion and conclusion

In Senegal, smallholders' attributes with uncertainty in outcomes, general socioeconomic context (prices, rural practices, political and logistical challenges), environmental risks and potential risk aversion of decision makers contribute both to limit access to finance and thus constrain livestock productivity. To insufflate a real growth dynamic in the sector, livestock stakeholders have to invest, and in most cases they depend on credit to do that. However, credit rationing due also to persistent risks in livestock sector is, one reason for the mismatch between credit supply and demand. The link between overall persistent risks and reduction of available credit is very weakly addressed even if in Senegal, this was already evoked during the 1988–91 banking crisis showing how drought precipitated the closure of seven banks (Caprio and Klingebiel, 1996).

Policy developments in recent years seem to be moving forward towards creating an enabling environment. For risk mitigation, risk transfer, and risk coping, GOS had launched various initiatives to address different degrees of severity. Amongst them, livestock insurance development, as risk transfer instrument, should contribute both to reducing vulnerability by giving compensation options against economic losses preventing in particular smallholders to use suboptimal coping strategies that weakens further a precarious food and nutritional status or keep away people from limited basic infrastructures (school, health center, markets etc.) and to develop productivity through revitalized investments.

In conceptual terms, time has also come to begin thinking seriously on the best way to go beyond short-term loans and to design dynamic models that allow decision-making under uncertainty and incorporate long-term borrowing in view to stabilize the emerging of real business environment.

Bibliography

Asante-Addo C., Mockshell J., Siddig K., Zeller M., 2016. Agricultural credit provision: What really determines farmers' participation and credit rationing? *5th International Conference of the African Association of Agricultural Economists*, September 23-26, 2016, Addis Ababa, Ethiopia

Binswanger, H. P., Rosenzweig, M. R., 1986. Behavioural and material determinants of production relations in agriculture, *Journal of Development Studies*. 22, 503–539.

Bonnet J., Cieply S., Dejardin M., 2016. Credit rationing or overlending? an exploration into financing imperfection, *Applied Economics*, 1-18.

Caprio, G., and D. Klingebiel. 1996. Bank Insolvencies: Cross Country Experience, Working Paper 1620, World Bank, Washington, DC.

D'Alessandro S., Fall A. A., Grey G., Simpkin S., Wane A., 2015. Senegal Agricultural Sector Risk Assessment, *World Bank - Agriculture Global Practice Note*, October, 8 p.

De Meza D.E., Webb, D.C., (1987), “Too Much Investment: a Problem of Asymmetric Information”, *Quarterly Journal of Economics*, 102, 281-292.

De Meza D.E., Webb, D.C., (2000). Does Credit Rationing Imply Insufficient Lending? *Journal of Public Economics*, 78, 215-234.

Dercon, S. (1996). Wealth, Risk and Activity Choices: Cattle in Western Tanzania. *CSAE Working Paper Series* 1996-08, Centre for the Study of African Economies, University of Oxford.

Ellis, F. (2000). The determinants of rural livelihood diversification in developing countries. *Journal of Agricultural Economics*, 51(2): 289-302.

Ghatak, M., Guinnane, T.W., 1999. The economics of lending with joint liability: theory and practice, *Journal of Development Economics*, 60, 195–228.

Hoff, K., Stiglitz, J. E., 1993. Imperfect information and rural credit markets: puzzles and policy perspectives. In: Hoff, K., Braverman, A., Stiglitz, J. E. (Eds.), *the Economics of Rural Organization. Theory, Practice, and Policy*. Oxford University Press, Oxford, pp. 33–52.

Jaffee, D., Stiglitz, J., 1990. Credit rationing. In: Friedman, B. M., Hahn, F. H. (Eds.), *Handbook of Monetary Economics*, vol. II. Elsevier, Amsterdam, pp. 838–888.

Niang M., Mbaye M., 2013. Evolution des exportations de bétail malien au Sénégal suite aux récentes crises, Rapport Final rédigé dans le cadre du projet USAID - APC AM/MSU/US AID Projet de Mobilisation des Initiatives en matière de Sécurité Alimentaire au Mali – Phase II (PROMISAM II)

Petrick, M. (2005), Empirical measurement of credit rationing in agriculture: a methodological survey, *Agricultural Economics*, 33: 191–203. doi:10.1111/j.1574-0862.2005.00384.x

Reardon, T. (1997). Using evidence of household income diversification to inform study of the rural nonfarm labor market in Africa. *World Development*, 25(5): 735-747.

Reyes, A., & Lensink, R. (2011). The Credit Constraints of Market-Oriented Farmers in Chile. *Journal of Development Studies*, 47(12), 1851–1868.

Simtowe, F., Zeller, M., & Diagne, A. (2009). The impact of credit constraints on the adoption of hybrid maize in Malawi. *Review of Agricultural and Environmental Studies*, 90(1), 5–22.

Simtowe, F., Zeller, M., and Diagne, A. (2008). Who is Credit Constrained? Evidence from Rural Malawi. *Agricultural Finance Review*, 68(2): 255-27.

Stiglitz J. E., Weiss A., 1981. Credit rationing in markets with imperfect information, *The American Economic Review*, Volume 71, Issue 3 (June), 393-410

Wane A., Mballo A. D., 2016, Sénégal – Evaluation des Risques du Sous-secteur de l’Elevage, Rapport d’Expertise pour PARM-FIDA, Juin, 93 p.

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